Claims

What is claimed is:

1. A method, comprising:

providing a microarray comprising a plurality of DNA cells;

placing the microarray in an optical degenerate four-wave mixing (DFWM) system operating at an optical wavelength within an absorption spectral range of the DNA cells to generate a DFWM signal in one DNA cell;

collecting and measuring the DFWM signal; and

scanning a position of the mciroarray to place other DNA cells in the DFWM system to get respective DFWM signals.

2. The method as in claim 1, wherein the microarray has a blank area between two adjacent DNA cells, and the method further comprising:

scanning the blank area through the DFWM system to measure a signal; and

using the measured signal in the blank area to determine background optical noise.

3. The method as in claim 1, further comprising:

scanning the position of the mciroarray to place different locations within a DNA cell in the DFWM system to obtain different DFWM signals from the DNA cell; and

using the different DFWM signals from the DNA cell to determine inhomogeniety within the DNA cell.

4. The method as in claim 1, wherein the microarray is prepared by:

processing a substrate to form cell areas with oligonucleotides;

removing unbound target sequences; and

hybridizing the substrate.

5. The method as in claim 1, further comprising using a forward-scattering DFWM configuration in the DFWM system to produce each DFWM signal.

6. The method as in claim 5, wherein the forward scattering DFWM configuration receives one pump beam and one probe beam to produce a DFWM signal.

7. The method as in claim 1, further comprising using a backward-scattering DFWM configuration in the DFWM system to produce each DFWM signal.

8. A method, comprising:

providing a microchip having metal ions chelated in a compound in a solution;

performing a capillary electrophoresis process to separate the metal ions from the compound in the solution;

directing optical beams to overlap on the microchip in a four wave mixing configuration to obtain a wave mixing signal; and

using the wave mixing signal to determine a concentration of the metal ions.

9. The method as in claim 8, further comprising:

prior to providing the microchip with the solution having metal ions chelated in the compound, supplying a solution without the metal ions and the compound to the microchip;

aligning the optical beams to overlap on the microchip in the four wave mixing configuration to obtain a testing wave mixing signal; and

optimizing optical alignment according to the testing wave mixing signal.

10. The method as in claim 8, further comprising using a forward-scattering DFWM configuration to produce the wave mixing signal.

11. The method as in claim 10, wherein the forward scattering DFWM configuration receives one pump beam and one probe beam to produce a DFWM signal.

12. A method, comprising:

providing a sample liquid comprising proteins bound to a chromophore label;

directing optical beams to overlap in the sample liquid in a four wave mixing configuration to obtain a wave mixing signal; and

using the wave mixing signal to determine an amount of the proteins in the sample liquid.

13. The method as in claim 12, further comprising measuring a shift in frequency in the wave mixing signal that is caused by presence of the proteins.

14. The method as in claim 12, further comprising using a forward-scattering DFWM system to produce the wave mixing signal.

15. A system, comprising:

a laser to produce a laser beam;

means for splitting the laser beam into a pump beam and a probe beam;

means for directing the pump and probe beams to overlap at a sample location in a forward-scattering four wave mixing configuration;

a microarray having a plurality of cells located to place one cell in the sample location to receive the pump and probe beams and to generate a wave mixing signal; and

an optical detector located to receive the wave mixing signal.

16. The system as in claim 15, further comprising a template located between the microarray and the optical detector to filter light from the microarray and to transmit the wave mixing signal to the optical detector.